



## REVIEW ARTICLE ON HEPATOPROTECTIVE ACTION OF *KATUKI*

Dr. Prachi Gangwar<sup>1\*</sup>, Dr. Love Krishna Pal Singh Rathore<sup>2</sup>, Dr. Rashmi Gupta<sup>3</sup> and Dr. Lakshman Singh<sup>4</sup>

<sup>1</sup>Junior Resident, Department of Shalya Tantra, Faculty of Ayurveda, Institute of Medical Sciences, Banaras Hindu University, Varanasi-221005, Uttar Pradesh, India.

<sup>2</sup>Junior Resident, Department of Shalya Tantra, Faculty of Ayurveda, Institute of Medical Sciences, Banaras Hindu University, Varanasi-221005, Uttar Pradesh, India.

<sup>3</sup>Assistant Professor, Department of Shalya Tantra, Faculty of Ayurveda, Institute of Medical Sciences, Banaras Hindu University, Varanasi-221005, Uttar Pradesh, India.

<sup>4</sup>Professor and Head, Department of Shalya Tantra, Faculty of Ayurveda, Institute of Medical Sciences, Banaras Hindu University, Varanasi-221005, Uttar Pradesh, India.

\*Corresponding Author: Dr. Prachi Gangwar

Junior Resident, Department of Shalya Tantra, Faculty of Ayurveda, Institute of Medical Sciences, Banaras Hindu University, Varanasi-221005, Uttar Pradesh, India.

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### ABSTRACT

Gallstones are the most common extrahepatic biliary pathology. Gallstones affect approximately 5-25% of adults in the Western world. Gallstones are crystalline deposits in the gallbladder. The prevalence of gallstones varies between 5% and 25%, with a higher prevalence in Western countries, women, and older age group. The cholelithiasis management is symptomatic and primarily aims at removing the stones from the gallbladder or biliary ducts. In modern several drugs to dissolve gall stones has been described but at the same time it may produce side effects like mild diarrhoea, temporarily raised level of blood cholesterol, prolonged duration of therapy, after leaving the therapy recurrence occur etc. Thus, this review article brings together various properties and medicinal uses of highly valuable drug *Katuki* (*Picrorhiza kurroa*) described in Ayurveda, along with phytochemical and pharmacological properties. The purpose of this review is to highlight all the existing properties of *P. kurroa* with a special focus on its hepatoprotective and lithotrypsic activity which may provide incentive for better evaluation of plant as medicinal agent.

**KEYWORDS:** Cholelithiasis, *Katuki*, Lithotrypsic, *Picrorhiza kurroa* etc.

### INTRODUCTION

*Picrorhiza kurroa* is a well-known herb in ayurvedic medicine system. The name *picrorhiza* is derived from bitter root where *picros* means bitter and *rhizos* means root.<sup>[1]</sup> It is a small perennial herb belongs to *scrophulariaceae* family, found in himalayan region. *Picrorhiza kurroa* has a long creeping rootstock that is bitter in taste and grow in root crevices and moist sandy places.<sup>[2]</sup> The active constituents are obtained from root and rhizome. *Picrorhiza kurroa* root contains *kutkin*, a bitter glycoside principle.<sup>[3]</sup>

In *Ayurvedic* literature references of *katuki* is found in scattered manner, in classical texts such as in *Charak samhita*<sup>[4]</sup>, *Susruta samhita*<sup>[5]</sup>, *Sharangdhara samhita* (various formulations are mentioned in which *katuki* is the main ingredient)<sup>[6]</sup>, *Dhanwantri nighantu* (various synonyms of *katuki* are described like *matsyaskala*, *katuka*, *tikta*, *cakrangi*, *asokarohini*, *tiktakarohini*, *arista*, *janani*. Here also the properties of *katuki* is been mentioned like *tikta*, *katu*, *pittajit*).<sup>[7]</sup> Now in modern era, it has been widely used as a single herb and also as a

constituent in different products available in market, thus exhibiting its therapeutic potential in several disorders.

Gallstone disease is common abdominal surgical emergency with a substantial burden to health care systems. The prevalence of Gallstone disease varies widely by region. This is connected with a change in life style, reduction in motor activity, reduction of the physical load and changes to diets.<sup>[8]</sup>

The pathogenesis of gallstone disease is suggested to be multifactorial and probably develops from complex interactions between many genetic and environmental factors.<sup>[9]</sup> Gallstone formation is favoured by bile stasis due to gallbladder dyskinesia resulting from gallbladder wall pathology and also due to exposure of gallbladder mucosa to high concentrations of mucus, calcium and lipids. Increased prevalence of gallstones seen in many patients because of decrease in the activity of cholesterol reductase and increase in activity of HMG CoA reductase resulting in increased cholesterol secretion and saturation of bile.<sup>[10]</sup>

The present era is a time of technological advancements coupled up with stringent uses of drugs that are bound to give values. Thus there lies an utmost necessity to focus on the herbal drug which possesses hypolipidemic, lithotrypsic property and hepatoprotective property.<sup>[10]</sup>

## MATERIALS AND METHODS

*Katuki (Picrorhiza kurroa)* is an important and widely used herb in ayurvedic medicine. It belongs to the family Scrophulariaceae.

**Gana:** It is included in four different ganas in by Acharya Charak i.e. *bhedaniya*, *deepaniya*, *stanyashodhan*, *tiktakandh* gana<sup>[11]</sup>, and in three different ganas by Acharya Susruta i.e. in *patoladi*, *pippalyadi*, *mustaadi* gana.<sup>[12]</sup>

### Ayurvedic Properties<sup>[13,14]</sup>

*Rasa:* Tikta, Katu

*Guna:* Laghu

*Veerya:* Ushna

*Vipaka:* Katu

*Prabhava:* Pittahara, Hridya, Deepaniya, Bhedaniya, Jwarhara.

Parts used: Dried Roots & Rhizomes



**Chemical constituents:** Kutkin, D-Mannitol, steroids, apocyanin, picroside.

### Pharmacognostical Evaluation

**Microscopy of rhizome of *Picrorhiza kurroa* and its powder character:** Transverse section of *Picrorhiza* rhizome shows the important parts like cork, cambium, cortex, endodermis, xylem, phloem and pith and also in powder microscopy starch grains, pigment cells, and cortical parenchyma can be seen.<sup>[15]</sup>

### Analytical study

**HPTLC:** In *Picrorhiza kurroa* the two iridoid glycosides kutkoside and picroside-I were found to have the active hepatoprotective principles and their quantification was performed for the routine quality control of Kutki extract. For the Quantitation of these phytoconstituents a precise and rapid thin-layer chromatography (TLC) method was developed. The analysis was performed in previous studies on a TLC precoated silica gel 60 F254 plate with ethyl acetate: methanol: glacial acetic acid: formic acid (25:5:1:1) as mobile phase and proved that, In *Picrorhiza kurroa*, picroside I and II are the active

ingredients responsible for its medicinal effect. These chemical constituents vary according to different plants at different altitudes & this is analyzed by HPLC studies. The plants collected from the lower altitude contains less picroside content as compared to plants collected from higher altitude.<sup>[16,17,18]</sup>

### Hypothesis in Mechanism of action of katuki according to Ayurveda

Gallstone form when the bile, that is stored in the gallbladder, hardens into pieces of solid material. This process requires three mechanism. a) Supersaturation of bile with cholesterol, b) cholesterol crystal nucleation, c) Gallbladder hypomotility. In Ayurveda it is mentioned as “katuki pitta virechana sarvshreshtha”<sup>[28]</sup> i.e. Kutki is best of removal of excessive *Pitta* from the body via colon. It removes toxins from the colon and has *pitta*, *kapha* *doshahara* properties. Katuki is nature’s best choleraics i.e. prevents bile(*pitta*) + cholesterol(*kapha*) supersaturation, prevents *dosha* accumulation by increasing contractions of gall bladder and take out the secretions, in turns prevents gallstone precipitation. This helps in improved digestion, regulation of fat, Proteins and carbohydrate metabolism and decreases cholesterol concentration i.e.hypolipidemic action. Since liver is the seat of all metabolism, the action leads to correction of so many disorders and possess hepatoprotective action.<sup>[25]</sup>

### Pharmacological Properties of Katuki<sup>[19]</sup>

*Picrorhiza Kurroa* uses

*Asrajit* – being coolant, useful in bleeding disorders such as menorrhagia, nasal bleeding etc.

*Dahajit* – relieves burning sensation (as in case of diabetic neuropathy).

*Arochaka* – useful in anorexia.

*Vishamajvara* – useful in chronic recurrent fever.

*Bhedani*, *Rechani* – piercing, causes purgation / diarrhea.

*Deepani* – improves digestion and metabolism.

*Hrudya* – good for heart.

*Kapha Pitta Jwarapaha* – useful in fever of *Kapha* and *Pitta* origin.

*Prameha* – useful in urinary tract disorders, diabetes.

*Shvasa* – useful in asthma, dyspnea.

*Kasa* – useful in cough, cold.

*Kushtahara* – useful in skin disorder.

It acts as a potent liver stimulant. In higher doses, it acts as purgative.

It is very useful in relieving intestinal worm infestation. It is useful in weight loss treatment. Useful in restoration of liver function.<sup>[3]</sup>

### Scientific Validation of Therapeutic Properties of Katuki

**Digestive activity:** *Picrorhiza* is used in India for the people with constipation due to insufficient digestive secretions.<sup>[20]</sup>

**Hepatoprotective activity:** Alcoholic extract of the plant and kutkin possess hepatoprotective activity. Plant is a potent immunostimulant of both cell mediated and hormonal immunity and exhibits choleric activity in dogs.<sup>[20]</sup> The hepato-protective effect of *Picrorhiza kurroa* roots have been shown in diverse models of liver injury. The crude extract, and the isolated active principles of the roots have been shown to protect the liver from various types of drug-induced injury isolated compounds from *P. Kurroa* have also been shown to have hepatoprotective activity.<sup>[20]</sup>

**Immunomodulatory activity:** *Picrorhiza kurroa* was found to be a potent immunostimulant of both cell-mediated and humoral activity.<sup>[20]</sup>

**Hypolipidemic activity:** A hypolipidemic effect of the water extract of *Picrorhiza kurroa* was observed in a high fat diet feeding hyperlipidemic mouse at doses of 50, 100 and 200 mg/kg, orally, once a day for 12 weeks. Liver weight, serum aspartate transferase (AST), alanine transferase (ALT), low density lipoprotein (LDL), triglyceride and total cholesterol levels were significantly reduced by the treatment. On the contrary, serum HDL level seems not affected by *P. Kurroa* water extract.<sup>[21]</sup>

**Anti-inflammatory activity:** Apocynin is a constituent of root extracts of *Picrorhiza* and has been reported to possess anti-inflammatory properties in laboratory animals. Apocynin concentration dependently inhibited the formation of thromboxane A<sub>2</sub>, whereas the release of prostaglandins E<sub>2</sub> and F<sub>2α</sub> was stimulated. Apocynin inhibited arachidonic acid induced aggregation of bovine platelets, possibly through inhibition of thromboxane formation. The rhizome of *Picrorhiza scrophulariiflora* is used to treat inflammatory diseases as a traditional medication. The ethanol extract of *Picrorhiza scrophulariiflora* in rabbits improves accelerated atherosclerosis through inhibition of redox-sensitive inflammation.<sup>[22]</sup>

**Classical Formulations** containing *Kutki* as an ingredient

1. Arogya Vardhini Vati (Bhaisjya Ratnawali Kustha adhikar 54/111-117).
2. Sarivadyasava (Bhaisjya Ratnawali Prameha pidika adhikar 38/22-27).
3. Mahatiktaka Ghrita (Bhaisjya Ratnawali Kustha adhikar 54/237-243).
4. Mahayograj Guggul (Sharangdhar samhita Madhyam khand 7/56-59).

## DISCUSSION

Gallstones are hardened deposits of the digestive fluid bile that can form within the gallbladder. They vary in size and shape form as small as a grain of sand to as large as a golf ball.<sup>[1]</sup> Gallstones occur when there is an imbalance in the chemical constituents of bile that result in precipitation of one or more of the components. Therefore a plant possessing lithotrypsic action along

with hypolipidaemic and antacid property when administered orally, will be better for the management of gallstone. In Ayurveda some of the plants have been identified which acts as potent liver stimulant and helps in improving liver metabolism *P. kurroa* is amongst those identified plant materials. *Picrorhiza kurroa* has focused on its hepatoprotective, anticholestatic, antioxidant, and immune-modulating activity. Kutki has hepato-protective properties and thus supports the liver and spleen. It is used in all forms of liver damage, cirrhosis and inflammation of the liver. It protects the liver against damage from the hepatitis C virus. *Picrorhiza kurroa* rhizome extract has significant choleric effect, which can greatly increase the excretion of the bile salt, cholic acid and deoxycholic acid and thus prevent the hepatic injury and formation of gall stone.<sup>[27]</sup>

## CONCLUSION

In the present review article, an attempt has been made to assemble the thorough description on *Picrorhiza kurroa* by enlightening its pharmacognostical, morphological, pharmacological, phytochemical, therapeutic and nutritional values. While assessing various journals, manuscripts, and textbooks on this plant we found that *P. kurroa* has exposed good action on liver protection, respiration system, antiameobic and antibacterial activity as well as potent antidiabetic action. Although researches on *P. Kurroa* and its alkaloids has gained a special attention in recent times but there is a need of more well documented clinical trials and more laboratory work to isolate the active principles, their pharmacological actions and toxicity. Further studies on *P. Kurroa* are required to isolate and characterize the bioactive anticholeric principles from the plant which can therefore be used as an alternative remedy for the treatment of gallstones.

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